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AF/IFW

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicants: Arnold et.al.

Title: TORSIONAL MAGNETORHEOLOGICAL DEVICE

Filing Date: October 23, 2003

Serial No. 10/693,853

Examiner: Xuan Lan T. Nguyen

Group Art Unit: 3683

Attorney Docket No. LEW 17,510-1

CERTIFICATE OF MAILING UNDER 37 CFR 1.10(a)

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- Three copies of Reply Brief (26 pages), with:
  - Claims Appendix (4 pages)
  - Evidence Appendix (1 page)
  - Related Appeals Appendix (1 page)
- Mailing Receipt Card

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Sent to Addressee using Express Mailing Label No. EQ 442568819 US on this 12 day of September, 2006.
Kent N. Stone

September 10, 2006

Board of Patent Appeals and Interferences
Commissioner for Patents
P. O. Box 1450
Alexandria, Va. 22313-1450

REPLY BRIEF

Dear Sir:

This reply brief includes all of the previous facts and arguments made in the previously filed briefs of appellants/applicants and is in response to the Examiner's Answer Brief dated August 1, 2006, applicant responds as follows. The italicized portions of this brief indicate the response to the Examiner's Answer Brief. In other words the italicized portions of this brief represent the material added to the previously filed First Supplemental Appeal Brief filed December 12, 2005. This Reply Brief is believed to be in compliance with MPEP 1208.

REAL PARTY IN INTEREST

The real party in interest is the National Aeronautics and Space Administration.

RELATED APPEALS AND INTERFERENCES:

There are no other appeals or interferences which will directly *or indirectly* affect or have a bearing on the Board's decision in this pending appeal. *There are no judicial proceedings which will directly or indirectly affect or have a bearing on the Board's decision in this pending appeal.*

STATUS OF THE CLAIMS:

Claims 12-14 have been canceled. Claims 4 and 5 are withdrawn. Claims 1-3, 6-11 and 15 have been finally rejected, are under appeal and are found in the attached appendix.

STATUS OF AMENDMENTS:

No amendments filed subsequent to the final rejection have been made to the claims or the description.

SUMMARY OF THE CLAIMED SUBJECT MATTER:

Claim 1 recites the following subject matter. A magnetorheological device comprising a generally cylindrically shaped housing 100 having cylindrical walls 101 and a divider 104 within the housing 100. The housing includes an integral end portion 110A and an end plate 110B removably attached to the cylindrically shaped housing 100. A rotary impeller includes two paddles 106, 108 mounted within the housing. The rotary impeller sealingly 116 engages the divider 104. The paddles 106, 108 in combination with the cylindrical walls 101, the divider 104, the integral end portion of the housing 110A, and the end plate of the housing form a first chamber 102 and a second chamber 103. Magnetorheological fluid resides in the chambers 102, 103 and a passageway 111A interconnects the first and second chambers. The coil 115 surrounds a portion of the passageway 111A enabling the viscosity of the magnetorheological fluid to be varied. See, specification, page 5, line 16 to page 6, line 20 and specification, page 7, line 11 to page 7, line 20.

Independent Claim 15 recites the following subject matter. A magnetorheological device comprising a generally cylindrically shaped housing 100 having cylindrical walls 101 and a divider 104 extending inwardly from the housing 100. A hub 105A includes a first impeller 105 and a second impeller 108 which straddle the divider. The rotary impeller sealingly 116 engages the divider 104. The paddles 106, 108 in combination with the cylindrical walls 101 and the divider 104 form a first chamber 102 and a second chamber 103. Magnetorheological fluid resides in the chambers 102, 103 and a passageway 111A interconnects the first and second chambers. The coil 115 surrounds a portion of the passageway 111A enabling the viscosity of the magnetorheological fluid to be increased with application of additional magnetic flux. The hub and the impellers rotatably push the magnetorheological fluid against the divider and the plug such that the magnetorheological fluid is in compression. See, specification, page 5, line 16 to page 6, line 20 and specification, page 7, line 11 to page 7, line 20. Also see, specification, page 8, line 11 to specification, page 8, line 15.

The invention is a torsional magnetorheological device based primarily upon the compression of the magnetorheological fluid. The torsional magnetorheological device comprises a generally cylindrical housing having a divider within the housing. Preferably the housing is machined and it has one open end and one closed end. The divider functions to separate two compartments or chambers 102, 103 within the device. A rotary impeller is affixed to a hub 105 and has two paddles 106, 108 which sealingly reside within the housing. The rotary impellers 106, 108 sealingly 107, 109 engage the divider 104 and the housing 110A, 110B. See, Figs. 1, 1A, 1B, and 2.

The paddles in combination with the divider form first and second chambers. A magnetorheological fluid resides in the chambers. When subjected to a magnetic field generated from a coil 115 the viscosity of the magnetorheological fluid increases substantially. The coil 115 is preferably a direct current coil but it may also be an alternating current coil which includes a rectifier.

A passageway 111A interconnects the first and second chambers 102, 103. The coil 115 surrounds the passageway 111A. Optionally, the passageway 111A may be a tortuous passageway as illustrated in Fig. 1C.

Because the magnetorheological fluid is used primarily in compression, high loads and a compact design are attainable. Similarly because this device is designed to be employed under torsion it can be installed virtually anywhere a hinge requires a holding device and due to the variable viscosity of a magnetorheological fluid the rate of closing of a hinge device is easily controllable.

The paddles 106, 108 may be rotated in either direction making the device bi-directional. The compression is created by the paddles 106, 108 pushing the fluid against the divider 104 and the plug which is created in an exterior by pass line or exterior passageway 111A. Optionally, the exterior passageway may include a tortuous path as illustrated in Fig. 1C.

The brake/holding device works on the incompressiblity principle of fluids. Because the device relies on less than 360 degrees of rotation it can be utilized reversibly over a given angle of rotation and in such a way as to allow the fluid's shear strength limitation to be by-passed. This is achieved by passing fluid from one chamber to another through tubing. The aforementioned magnetic field is applied to a by-pass wherein the fluid is solidified when the coil is energized.

Fig. 1 is a partial cross sectional view 100 of an embodiment of the invention. Housing 110 includes generally cylindrically shaped walls 101 shown in cross section as well as a fixed end portion 110A illustrated in Fig. 1. End portion 110B is illustrated in Fig. 2. Divider 104 separates and forms chambers 102, 103. Impellers 106 and 108 are affixed to hub 105. Hub 105 includes a bore 105A which may be splined to receive a splined shaft. Bore 105A receives a rotating shaft and impellers 106 and 108 rotate with said shaft. The shaft (not shown) is affixed to the bore 105A. It may be keyed or splined to the bore 105A.

Magnetorheological fluid resides in chambers 102 and 103 and seals 107, 109 and 116 prevent the fluid from leaking by the interfaces between the impellers 106, 108 and the cylindrical wall 101 and the ends 110A and 110B of the housing. Particularly seal 107 prevents leakage between impeller 106 and cylindrical wall 101 and seal 109 prevents leakage between impeller 108 and cylindrical wall 101. Preferably seals 107 and 108 are elastomeric seals and they are attached to the impellers with an adhesive or through use of a mechanical or frictional fastener. Housing 110 includes a smooth interior 101A against which seals 107 and 108 act. Seal 116 is also preferably elastomeric and seals between cylindrical hub 105 and divider 104. Seal 116 is affixed to the divider 104 with adhesive. Alternatively, seal 116 could be in the configuration of impeller seals 107 and 109. Seals 201 and 202 function to seal between the impellers 106, 108 and the end portions 110A and 110B of the housing. In this way, chambers 102 and 103 are completely sealed as impellers 106 and 108 rotate in unison.

As hub 105 rotates, impellers 106, 108 rotate as indicated by arrow 131. Fluid in chambers 102 and 103 is moved therebetween through passageway 111A. Passageway 111A is formed by tubing or piping 111/113 which is integral with housing 101. Alternatively, the passageway 111A may be formed with tubing affixed to the housing or fittings affixed to the housing. Bidirectional arrows 112, 114 indicate that the flow of magnetorheological fluid may occur in either direction to and from chambers 102, 103. Arrow 131 indicates rotation of impellers 108, 106 about hub 105.

Coil 115 is preferably a direct current coil but it can also be an alternating current coil employing a rectifier. Symbols V^+ and V^- indicate a voltage potential across the coil 115. As fluid is pushed through passageway 111A, a magnetic field is generated which tends to solidify the magnetorheological fluid in passageway 111A. The orientation of the magnetic field is dictated by the orientation of the coil 115 which surrounds the passageway. The coil generates a magnetic field with lines of flux aligned in parallel with the direction of flow of the magnetorheological fluid which results in a compressive plug. The viscosity of the magnetorheological fluid increases with increased current through the coil and with increased magnetic flux. As the viscosity of the fluid increases sufficiently, the fluid subjected to the magnetic flux acts as a plug and the fluid cannot pass through the passageway 111A. The impellers are then pushing the fluid against the divider and against the plug which retards (i.e., dampens) and/or stops (i.e. brakes) the rotary motion of the impellers.

Fig. 1C is a partial cross sectional view 100C of another embodiment of the invention illustrating a tortuous passageway 111C and a coil 115C surrounding the tortuous passageway 111C. A tortuous passageway may be used if desired to increase maximum breaking resistance. Regardless of the volume of fluid use, the viscosity will vary according to the flux applied thereto. See, specification pages 5-8.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

ISSUES

Issue 1. Did the Examiner correctly reject Claims 1-3, 6-11 and 15 under 35 USC 103(a) as being unpatentable over Park et al. (USP 6,095,295) in view of Johnston et al. (USP 6,318,522) and further in view of Rosaen (USP 3,448,751).

ARGUMENT

Issue 1

Whether or not the rejection of Claims 1-3, 6-11 and 15 is correct under 35 USC 103(a) as being unpatentable over Park et al. (USP 6,095,295) in view of Johnston et al. (USP 6,318,522) and further in view of Rosaen (USP 3,448,751).

Claims 1-3

In the rejection the Examiner correctly indicates that "Park lacks a second paddle in the structure of the rotary impeller." See, the May 20, 2005 final office action bridging the last sentence of page 2 and the first sentence of page 3 thereof. The Examiner further states at lines 3-7 page 3 of the office action that "[i]t would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Park's magnetorheological device to have comprised two paddles as taught by Johnston to further increase the adjustability of the damping capability of the device." The Examiner also correctly indicates that applicants' claim 1 requires "the coil to be surrounding a portion of said passageway" enabling the viscosity of the magnetorheological fluid to be varied <u>and</u> that Park lacks the claimed coil surrounding a portion of a passageway. See the final office action, page 3, lines 6-8. The Examiner further states at line 6, page 3, of the final office action that "Park shows the coil 122 being located at the end of passageway 125-129 while claim 1 requires the coil to surrounding (sic) a portion of the passageway. Rosaen teaches the concept of surrounding the passageway 18 of the MR fluid with a coil 20 as an effective way to vary the viscosity of the fluid in the passageway to control the flow, see column 2, lines 49-53. It would have been further obvious to one of ordinary skill in the art at the time the invention was made to have further modified Park's device with the coil surrounding the passageway such as taught by Rosaen wherein the magnetic field would be stronger and it would have been a much more effective way to vary the viscosity of the MR fluid as shown by Rosaen."

Park illustrates a coil 122 buried within annular solenoid 114/annular body 114 and beneath a seal 138. Park states at col. 3, lns. 52 et seq.:

"During swing of the wing 112, the magnetorheological fluid in the first fluid chamber 116A flows to the second fluid chamber 116B through the first hole 128, the first cylindrical space 126, the annular space 125, the second cylindrical space 127 and the second hole 129. The rotating direction of the wing 112 and the flow direction of the magnetorheological fluid are represented by arrows in Fig. 4."

Further, at col. 3, lns. 25 et seq., Park states:

"Upon magnetization of the annular body 121, two confronted ends 123 and 124 of the annular body 121 at the discontinuation act as magnetic poles having opposed polarities to each other. Furthermore, an opened annular space 125 formed between the ends 123 and 124 connects a first cylindrical space 126 to a second cylindrical space 127."

The orientation of Park's coil is not disclosed. However, Park identifies that opposite polarities exist across annular space 25 which leads to the reasonable inference, applying the right hand rule, that the current through coil 122 is emanating out of the left illustration of the coil as illustrated in Fig. 4. It is believed that the dark arrows illustrated around the coil 122 in Fig. 4 are representative of the flux lines. These flux lines are perpendicular to the direction of flow within the annular space 125. Figs. 6, 7A and 7B which are illustrated as prior art in Parks depict the orientation of the magnetic particles with opposite polarities being applied across a channel having magnetorheological fluid within. Also, Park, at col. 1, lines 27 et seq. describes the conventional rotary damper of Fig. 6 as being of the directive shearing type wherein the circular plate rotor cuts through, i.e., shears through, the fluid with the magnetic particles being arranged as illustrated in Fig. 7B. Fig. 7B illustrates lines of flux which are perpendicular to the circular plate rotor and the direction of its motion. Park, like the prior art identified therein, operates in shear, not compression.

The coil is buried beneath the annular space 125 which carries the magnetorheological fluid. The Examiner correctly recognizes that coil 122 does not surround a passageway or annular space. Claim 1 requires a coil which surrounds a portion of a passageway enabling the viscosity of the magnetorheological fluid to be varied. In applicants' claim 1 it is the flux within the coil surrounding the magnetorheological fluid which increases the viscosity of the fluid in proportion to the current through the coil. Applicant's coil creates a flux in the passageway 111A such that the lines of flux are substantially parallel to the direction of travel of the fluid.

The Examiner in the final rejection indicates that the teachings of Johnston '522 should be applied in combination with Park '095 because it would have been obvious to modify Park's magnetorheological device to have comprised two paddles as taught by Johnston to further increase the adjustability of the damping capability of the device.

First, applicant's invention has two paddles but they have nothing to do with adjustability. Second, Park and Johnston are not properly combinable because Applicants teach compression of the magnetorheological fluid and Park and Johnston teach shearing of the magnetorheological fluid. See, col. 4, line 28 of Johnston and the gaps 38 illustrated in Fig. 2. Therefore, it is believed that it is not proper to combine the shearing technology of Park and Johnston with the compression technology of applicants.

Park and Johnston both teach shearing of magnetorheological fluid and this is consistent with their purpose of damping. Park at col. 2, line 15, recites a "narrowed flowing path" as does claim 1 of Park. Johnston, too, recites an outer gap 38 which restricts the flow of the MR fluid by increasing the viscosity of the fluid which adds a shear force that any fluid must overcome in order to flow through the outer gap 38. See, col. 4, lns. 28 et seq. of Johnston. The Examiner states that the tortuous path in Johnson is 54, not 38. The point is not the identification of the tortuous path but rather the establishment that Johnston is operating on shear principles.

Johnston states at col. 4, lines 20-45:

"The outer magnets 42 restrict the flow of magnetorheological fluid 56 between the outer surface 30 of the rotor 22 and the inner surface 34 of the housing 32. The viscosity of the fluid 56 increases in the presence of a magnetic field, and the increased viscosity restricts the flow of fluid through the outer gaps 38. It is believed that the iron particles in the magnetorheological fluid 56 align in the presence of a magnetic field, which increases the viscosity of the fluid 56. The increased viscosity adds a **shear force** that any fluid 56 must overcome in order to flow through the outer gap 38. In this manner, a controllable, restrictive seal is effectively formed between the rotor 22 and the housing 32 at the outer gaps 38. Thus the outer magnets act to restrict the flow of the magnetorheological fluid 56 through the outer gaps 38 in a radial direction (i.e. a direction opposite the movement of the rotor 22) by restricting the flow of fluid 56 across the surface 30 of the rotor 22.

Similarly, the inner magnets 50 help to provide a controllable, restrictive seal between the hub of the rotor 22 and the inner surface 46 of the guide plates."

The Examiner is attempting to assert the argument that Johnston and Park teach compression, not shearing. Applicants disagree.

The Examiner indicates that Park discloses a coil 122 at the end of passageway 125-129. In reality, from a close inspection of Park, it can be seen that the coil is buried beneath seal 138 and is not at the end of the passageway 125. The specification indicates that coil 122 is in a cavity of the annular body.

Since Park includes a coil 122 buried beneath the seal 138, Park would have to be completely redesigned to receive the coil of Rosaen to surround the narrow passageway 125 of Park. In fact, the narrow passageway would have to be redesigned as well. The modification of Park would entail winding the coil 122 around the passageway, not a mere shifting of position.

The Examiner states that "Rosaen teaches the concept of surrounding the passageway 18 of the MR fluid with a coil 20 as an effective way to vary the viscosity of the fluid in the passageway to control the flow. " (emphasis ours). An examination of Rosaen reveals that it is directed to the control of pressure, not flow. Rosaen discloses a pump which is discharging into two parallel flow paths and as flow is restricted or shut off by the coil 20, then the pressure will rise. A single speed pump such as the one illustrated in Rosaen operates on a single flow-discharge pressure curve such that increased discharge pressure occurs with attendant lower flow. First, Rosaen is attempting to control pressure and is not trying to damp or brake rotary action or shock. Therefore, the problem being solved by Rosaen (pump discharge pressure control) is different than the problem identified by Park and Johnston (damping rotary motion). Rosaen is not attempting to damp or arrest the rotation of the pump's impellers. To do so would destroy the pump.

Park and Johnston teach shearing the fluid and Rosaen teaches compression. Rosaen is really a pump pressure controller, not a brake and there is no motivation to combine them.

In his rejection, the Examiner wants to combine the references of Park and Johnston (both of which teach damping) together with Rosaen (which teaches pressure control) to arrive at applicants' claimed invention (cls. 1, 15) of a magnetorheological device which includes chambers and a coil surrounding a portion of a passageway which interconnects the chambers.

MPEP section 2143.01 indicates that the prior art must suggest the desirability of the claimed invention. "Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art. 'The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art.' Here, it is respectfully suggested that the Examiner is improperly combining the Park and Johnston references which teach shearing of the MR fluid with the Rosaen reference which teaches compression of the MR fluid in a pump bypass line to control pump pressure. Compression of the MR fluid is caused by surrounding the passageway with the energized coil to create lines of flux which are parallel to the direction of fluid travel. This contrasted with the lines of flux in Park and Johnston which operate on shearing through fluid having lines of flux imparted thereon which are oriented perpendicularly across the fluid channel.

The problem to be solved by the Rosaen reference (pressure control) is totally different from the problem to be solved by the Park and Johnston references (damping control). The references themselves do not explicitly provide any suggestion or motivation for combining the references. Nor can any suggestion or motivation be implicitly found since the references themselves are structurally different each from the other and they are directed toward solving different problems. Nor can any suggestion or motivation be implicitly found since the references are structurally different from the instant invention and they are each directed toward solving different problems using different technology.

In *In re Kotzab*, 55 USPQ2d 1313, 1318 (Fed. Cir. 2000) the court held that a "finding as to the specific understanding or principle within the knowledge of a skilled artisan that would have motivated one with no knowledge of [the claimed invention] to make the combination in the manner claimed" must be made. In the instant application, the Examiner has not identified a specific understanding or principle within the knowledge of the skilled artisan that would have motivated one with no knowledge of the claimed invention to make the combination in the manner claimed. The Examiner states that "Rosaen teaches the concept of surrounding the passageway 18 of the MR fluid with a coil 20 as an effective way to vary the viscosity of the fluid in the passageway to control the flow, see column 2, lines 49-53." However, nowhere does the Examiner identify the artisan given the differences in the problems to be solved, nor does the Examiner explain the motivation for combining the structure of Park and Johnston based on shear principles (and perpendicular lines of flux) with a much different structure of Rosaen based on compression principles (and parallel lines flux).

Instead, the Examiner merely states in the final office action page 6, line 19, that "[m]odifying Park's device with Rosaen's teaching of the arrangement of the coil is reasonable since Park already has the coil, moving it up to surround the passage to provide better effect on the MRF as taught by Rosaen would be obvious to one of ordinary skill in the art to take advantage of the improvement in effecting the MRF as taught by Rosaen." The Examiner makes no mention of the orientation of the flux lines or an understanding of them. Moving the coil up as suggested by the Examiner is a simplistic approach that would not produce the same effects as suggested by the Examiner because Parks and the prior art cited therein use lines of flux outside the coil, not within a coil which surrounds the flow channel. Moving the coil up as the Examiner suggests is not enough; it would also have to be rewound in some structure not suggested by the Examiner such that it would surround the flow channel and include lines of flux parallel to the channel.

The Examiner makes the argument that if the current is increased in Park or Johnston that the results are the same and therefore the devices are the same. Applicants respectfully suggest that there invention is patentably distinct and comprises structure which is totally different than the structure disclosed in Park or Johnston.

Assuming, arguendo, that a person of ordinary skill in some art had the three references of Park, Johnston and Rosaen before him/her, the Examiner has failed to identify what the art is and why the person would have the references before him/her. For example, if working in the art of rotary dampers why would a person of ordinary skill in that art be looking at the pressure controller of Rosaen in the first place. And, vice versa, if working in the art of pressure controllers why would a person of ordinary skill in that art be looking at the rotary dampers of Park and Johnston. Further, assuming arguendo, that a person of ordinary skill in the art of rotary dampers had the references of Park, Johnston and Rosaen before him would he/she look to combine them? To combine Rosaen with Park and/or Johnston it seems that the person of ordinary skill in the art would have to look at Rosaen with the thought that the pump's impellers would have to be retarded or damped in some way in order to make a mental connection with the rotary damping of Park and Johnston. This is a difficult assumption to make because it is possible that the pump of Rosaen could be other than a rotary pump. Further, there is no teaching or suggestion in Rosaen to dampen or retard the pump so a leap of logic is required to combine the teachings of the three references even if for some reason they were before a person of ordinary skill in the art of rotary dampers. It must be remembered that a person of ordinary skill in the art is a person that would not innovate. A person of ordinary skill in the art is one who thinks along the line of conventional wisdom and does not take to innovate. *Standard Oil Co. v. American Cyanamid Co.*, 774 F.2d 448, 454, 227 USPQ 293 (Fed. Cir. 1985).

Response to Examiner's Answer Brief in regard to claims 1 and 15

This response is equally applicable to claims 1 and 15 and the claims which depend therefrom.

In paragraph 10 of the Examiner's Answer Brief the Examiner correctly states that "[a]ppellant argues that Park and Johnston teach shearing of the MR fluid while Rosaen teach (sic) compression of the MR fluid and it would not be obvious nor proper to combine Park and Johnston in view of Rosaen." However, this is not the complete argument of the appellants as can be seen above. The Examiner has completely ignored and belittled the structure of the claimed invention ***(which includes the recitation of a coil surrounding the passageway)*** *and thus attempts to reduce the significance of the structure of the invention. The Examiner does nothing more than simplistically conclude that all he has to do is locate a reference or references which disclose coils located in any orientation with respect to magnetorheological fluid to render claim 1 obvious. The Examiner also asserts that "shearing" and "compression" result in "viscosity" changes and that it doesn't really matter whether "shearing" or "compression" are occurring in the invention because "compression technology is not claimed." Further, the Examiner apparently contradicts himself and states that "claim 1 claims both shearing technology and* *compression technology since the viscosity can be varied from slightly thickening to forming a solid plug."*

The Examiner goes on to state that "[s]ince claim 1 does not exclude a situation of shearing the MRF, Park, in view of Johnston and further in view of Rosaen meet the claimed features of claim 1."

It is respectfully suggested that the Primary Examiner may not understand the claimed structure set forth in claim 1 which specifies " a coil surrounding a portion of the passageway". The terms "compression" and "shearing" are not used in claim 1 and those terms have been used by appellants/applicants to explain the differences in structure and function between claims 1 and 15 of the instant application and the references of Park, Johnston and Rosaen. When the claimed structure is used the poles of the magnetic particles align with the flux applied and the magnetic particles are oriented parallel to the conduit with the poles of the magnetic particles aligned with north and south poles created by the flux of the coil. Appellants/applicants are using this parallel orientation of the magnetic particles to describe the "compression" of the magnetorheological fluid as that term is used in claim 15 and in the arguments made herein. By compression it is meant that the directional flow of the fluid is parallel to the flux lines and shear means that the flow of the fluid is perpendicular to the flux lines. See, for example Figs. 7A and 7B which exhibit a shearing example.

Reference is made to the drawing figures 2 and 3 of United States Patent Number 3,448,751 to Rosaen patent reproduced below which illustrate the alignment of the magnetic particles within the magnetorheological fluid.

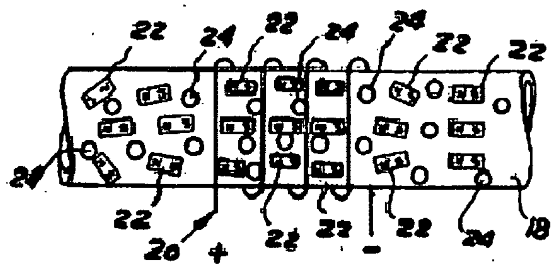


FIG. 2

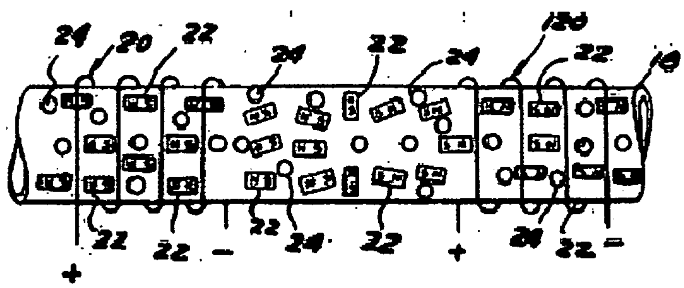


FIG. 3

The Primary Examiner's Answer Brief in summary is that magnetorheological fluid thickens in an amount dependent on the strength of the current. *This ignores the structure of the invention as set forth in independent claims 1 and 15 because those claims recite a coil surrounding the passageway.*

Reference is made to Figs 7A and 7B of Park which illustrate the alignment of the magnetic particles in the magnetorheological fluid in the condition of shearing. Park and Johnston employ shearing and not compression because of the orientation of the magnetic flux lines, to wit, they are perpendicular to the direction of the flow of the fluid or the *relative movement of the mechanical device with respect to the fluid. See, Figs. 6, 7A and 7B of Park reproduced below.*

FIG. 6

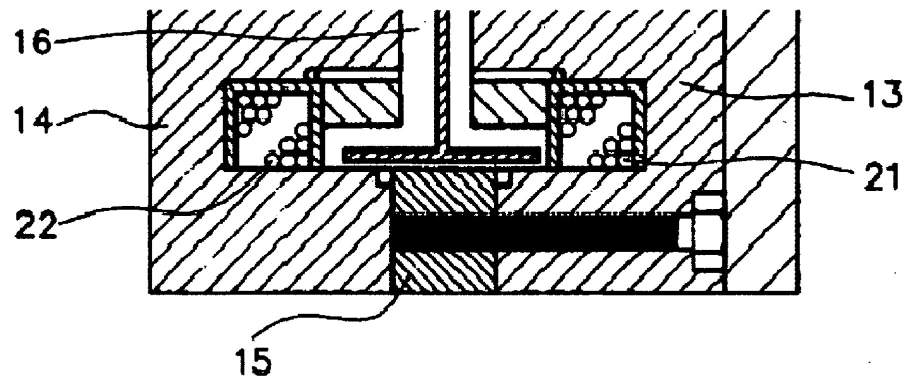


FIG. 7A

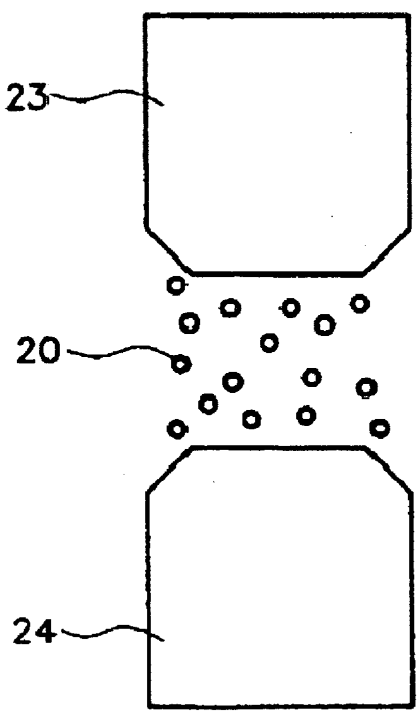
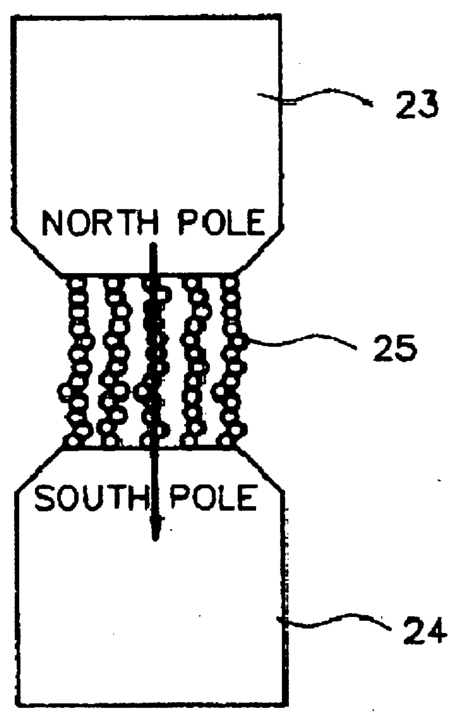


FIG. 7B



The flux lines are oriented differently in Park and Johnston because the coil of Park does not surround the passageway and the magnets of Johnston are not coils and are oriented differently.

The alignment of the magnetic particles (parallel to the conduit due to parallel lines of flux) as described and taught by Rosaen is different than the perpendicular alignment of the particles as indicated by the polarity across the passageway created by the coil of Park and the magnets of Johnston since they apply the magnetic flux perpendicularly to the fluid flow. Park states [u]pon magnetization of the annular body 121, two confronted ends 123 and 124 of the annular body 121 at the discontinuation act as magnetic poles having opposed polarities to each other. This means that the flux is being applied across the fluid passageway perpendicularly to the direction of fluid flow. This difference emphasizes that the orientation of Park's coil does not surround the passageway as that structure is recited in claims 1 and 15 of the claimed invention.

Rosaen and the claimed invention as set forth in claim 1 apply the flux in the direction of the fluid flow.

The Examiner further states a new position in the Examiner's Answer Brief claiming that Appellants/Applicants are somehow claiming an inherent property of the magnetorheological fluid because all magnetorheological fluids would form a plug upon the application of sufficient current thereto. Appellants/Applicants are not claiming an inherent property of magnetorheological fluid; rather, appellants/applicants are claiming a ***structure (coil surrounding the passageway)*** *which includes a coil surrounding a* *portion of a passageway interconnecting first and second chambers. Park and Johnston do not have this feature and apply flux perpendicularly to the fluid flow through adjacent passageways. Rosaen does apply flux parallel to the flow of fluid. However, there is no basis to combine these references for the reasons stated above and not repeated.*

Given the foregoing argument, it is believed that the Examiner erred in the foregoing rejection. As such, claim 1 is patentable and a favorable decision determining patentability is requested. Claims 2 and 3, dependent on claim 1, are also allowable.

Claims 6-7

In the final office action, the Examiner states that in regard to dependent claims 6 and 7, that Park shows said passageway is interior to the housing 113 in sections of 128, 129 and exterior to the housing 113 in sections 125-127. Claims 6 and 7 are dependent on claim 1 which requires that a portion of the passageway be surrounded by the coil. The structure identified by the Examiner, namely, sections 128, 129 and sections 125-127 are not surrounded by a coil. As such, it is not believed that the rejection of the claims 6 and 7 is well taken. As such, claims 6 and 7 are patentable and a favorable decision determining patentability is requested.

Claims 8

Claim 8 recites a first edge seal extending from the first paddle and a second edge seal extending from the second paddle. The Examiner states that "Park shows a first edges seal 136 extending from the first paddle and would have comprised a second edge seal extending from the second paddle." It is not clear what the words "would have comprised" mean other than an admission by the Examiner that Park does not disclose a second edge seal or a second paddle. Furthermore, the seal 136 identified by the Examiner is not an edge seal—it is a seal which appears to be attached to wing 112. Claim 8 is clearly patentable. As such, claim 8 is patentable and a favorable decision determining patentability is requested.

Claim 9

Claim 9 recites a third inner seal affixed to the integral end portion and a fourth seal affixed to the end plate. The Examiner identifies the claimed third inner seal as seal 138 which seals the coil 122. The seal identified by the Examiner is not on the integral end portion of the Park device. As such, claim 9 is patentable and a favorable decision determining patentability is requested.

Claim 10

Claim 10 recites the passageway as including a tortuous path. The Examiner has identified Park's passageway 125-129 as a tortuous passageway. As previously stated, the passageway must include a surrounding coil and it is at this point that the tortuous curves are relevant. Claim 10 is clearly patentable. As such, claim 10 is patentable and a favorable decision determining patentability is requested.

Claim 11

Claim 11 recites a first edge seal extending from the first paddle, a second edge seal extending from the second paddle, a third inner seal affixed to the integral end portion and a fourth seal affixed to the end plate. Simply put, Park does not disclose a third inner seal or a fourth inner seal in any way shape or form. Seal 136 is affixed to the top of wing 112. Seal 137 is on the shaft. Seal 138 is on the coil 122. Claim 11 is clearly patentable. As such, claim 11 is patentable and a favorable decision determining patentability is requested.

Claim 15

The arguments made in regard to claim 1 above are incorporated herein by reference as they are applicable to the recited structure set forth in claim 15. The Examiner makes no mention in his rejection of claim 15 about a second paddle straddling the divider. In applicants invention, magnetorheological fluid resides in the first and second chambers which are formed by the first and second impellers straddling the divider. Park is different and has a single wing or impeller and it difficult to understand the concept of straddling with only one impeller. Straddling implies having a leg or impeller on both sides. The Examiner does not explain how the references allegedly teach or suggest the first and second impeller straddling the divider.

Claim 15 recites the fluid as being in compression as a result of the orientation of the coil surrounding the passageway creating a flux parallel to the direction of the fluid flow. The structure recited in claim 1 also creates a field with flux lines parallel to the direction of the fluid flow.

Response to the Examiner's Answer Brief in regard to claim 15

The response in regard to claim 1 above is incorporated herein without being copied word for word at this point in the brief. The arguments in connection with claim 1 are equally applicable to claim 15.

As such, claim 15 is patentable and a favorable decision determining patentability is requested.

SUMMARY AND CONCLUSION

Claims 1-3, 6-11 and 15 are patentable over the Park, Johnston and Rosaen references for the reasons stated above.

The Examiner's Answer brief includes the new assertion that Appellants/Applicants are asserting an inherent property of the magnetorheological fluid, namely that the fluid thickens when a current is applied. And, the Examiner is asserting that claim 1 includes compression and shearing or both; rather, appellants/applicants are simply arguing the differences between the claimed invention and the references and the lack of an express or implied motivation or suggestion to combine the references to arrive at the invention as claimed. The structure (coil surrounding the passageway and the other elements and limitations of the claims) of the claimed in invention is novel and non-obvious and the appellants/applicants are not claiming an inherent feature of the magnetorheological fluid.

Wherefore, it is respectfully requested that the rejection of the claims be reversed and that the same be determined as being allowable.

FEE

The Commissioner is hereby authorized to charge any fees in connection with this Reply Brief under 37 CFR 41.20 to deposit account no. 14-0116, or any credit any overpayment to deposit account no. 14-0116.

Respectfully submitted,

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicants: Arnold et.al.

Title: TORSIONAL MAGNETORHEOLOGICAL DEVICE

Filing Date: October 23, 2003

Serial No. 10/693,853

Examiner: Xuan Lan T. Nguyen

Group Art Unit: 3683

Attorney Docket No. LEW 17,510-1

September 10, 2006

Commissioner for Patents
P. O. Box 1450
Alexandria, Va. 22313-1450

CLAIMS APPENDIX

1. (Original) A magnetorheological device comprising:

a generally cylindrically shaped housing having cylindrical walls and a divider within said housing;

said housing includes an integral end portion and an end plate removably attached to said cylindrically shaped housing;

a rotary impeller having two paddles mounted within said housing;

said rotary impeller sealingly engaging said divider;

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Kent N. Stone

said paddles in combination with said cylindrical walls, said divider, said integral end portion of said housing, and said end plate of said housing form a first chamber and a second chamber;

a magnetorheological fluid residing in said chambers;

a passageway interconnecting said first and second chambers; and,

a coil surrounding a portion of said passageway enabling the viscosity of the magnetorheological fluid to be varied.

2. (Original) A magnetorheological device as claimed in claim 1 wherein said coil is a direct current coil.

3. (Original) A magnetorheological device as claimed in claim 1 wherein said coil is an alternating current coil.

4. (Withdrawn) A magnetorheological device as claimed in claim 2 further comprising a permanent magnet mounted in proximity to said passageway.

5. (Withdrawn) A magnetorheological device as claimed in claim 3 further comprising a permanent magnet mounted in proximity to said passageway.

6. (Original) A magnetorheological device as claimed in claim 1 wherein said passageway is exterior to said housing.

7. (Original) A magnetorheological device as claimed in claim 1 wherein said passageway is interior to said housing.

8. (Original) A magnetorheological device as claimed in claim 1 further comprising a first edge seal extending from said first paddle and a second edge seal extending from said second paddle.

9. (Original) A magnetorheological device as claimed in claim 1 wherein said housing includes a third inner seal affixed to said integral end portion and a fourth seal affixed to said end plate.

10. (Original) A magnetorheological device as claimed in claim 6 wherein said passageway includes a tortuous path.

11. (Original)A magnetorheological device as claimed in claim 1 further comprising a first edge seal extending from said first paddle, a second edge seal extending from said second paddle, a third inner seal affixed to said integral end portion and a fourth seal affixed to said end plate.

12. (canceled)

13. (canceled)

14. (canceled)

15. (Previously amended) A torsional magnetorheological device comprising:

a housing having a divider extending inwardly from said housing;

a hub having a first impeller and a second impeller rotatably mounted within said housing;

said first impeller and said second impeller straddling said divider;

a first chamber formed by said first impeller and said divider and a second chamber formed by said second impeller and said divider;

a passageway interconnecting said first and second chambers;

magnetorheological fluid in said chambers and said passageway;

a magnetic field generated by a coil surrounding said passageway such that an increase in said field increases the viscosity of the magnetorheological fluid;

said magnetorheological fluid in said passageway being solidified upon application of a sufficient magnetic field thereto forming a plug in said passageway;

said hub and impellers rotatably pushing said magnetorheological fluid against said divider and said plug such that said magnetorheological fluid is in compression.

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EVIDENCE APPENDIX

NONE

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